

WHAT IS CLAIMED IS:

1        1.        A liquid ejection apparatus, comprising:  
2                a head member, provided with nozzles including a plurality of nozzle  
3 groups each associated with one of a plurality of colors of liquid;  
4                a plurality of pressure fluctuation generator, each of which is operable  
5 to generate pressure fluctuation in liquid in each of the nozzles to eject a liquid  
6 droplet therefrom;  
7                a carriage, operable to carry the head member so as to reciprocately  
8 transverse a first region in which a medium, on which the liquid droplet is  
9 landed, is placed;  
10              a signal generator, operable to generate a first signal and a second  
11 signal;  
12              a controller, operable to drive the pressure fluctuation generator  
13 according to the first signal and ejection pattern data in a case where the head  
14 member transverse the first region in a first direction, and to drive the pressure  
15 fluctuation generator according to the second signal and the ejection pattern  
16 data in a case where the head member transverse the first region in a second  
17 direction opposite to the first direction; and  
18              a pattern data adjuster, operable to adjust the ejection pattern data so  
19 as to vary an ejected number of the liquid droplet per a unit area, for each of  
20 the nozzle groups.

1        2.        The liquid ejection apparatus as set forth in claim 1, wherein the first  
2 signal and the second signal are different from each other.

1        3.        The liquid ejection apparatus as set forth in claim 1, wherein the first  
2        signal and the second signal are identical with each other.

1        4.        The liquid ejection apparatus as set forth in claim 1, further  
2        comprising a tone confirmation controller, operable to control the pattern data  
3        adjuster, the controller and the carriage such that:

4                at least one first liquid mixing portion, at which liquid droplets of the  
5        plural colors are superposed, is formed on the medium when the head member  
6        transverses the first region in the first direction; and

7                a plurality of second liquid mixing portions, at which liquid droplets of  
8        the plural colors are superposed while varying the ejected number of the liquid  
9        droplet per the unit area, are formed on the medium when the head member  
10       transverse the first region in the second direction,

11               wherein the at least one first liquid mixing portion and the second  
12       liquid mixing portions are arranged on the medium in a comparative manner.

1        5.        The liquid ejection apparatus as set forth in claim 4, wherein a  
2        plurality of first liquid mixing portions are formed.

1        6.        The liquid ejection apparatus as set forth in claim 4, wherein:  
2                the medium is placed in the first region movably in a third direction  
3        perpendicular to the first direction and the second direction;

4                the second liquid mixing portions are arranged in the second direction;  
5        and

6           the first liquid mixing portion and the second liquid mixing portions are  
7       adjacent in the third direction.

1       7.       The liquid ejection apparatus as set forth in claim 4, wherein:  
2           the medium is placed in the first region movably in a third direction  
3       perpendicular to the first direction and the second direction;  
4           the second liquid mixing portions are arranged in the third direction;  
5       and  
6           the first liquid mixing portion and the second liquid mixing portions are  
7       adjacent in the second direction.

1       8.       The liquid ejection apparatus as set forth in claim 1, wherein the  
2       pattern data adjuster adjusts the ejection pattern data so as to vary relative  
3       percentages among liquid droplets of the respective colors in all liquid droplets  
4       ejected in the unit area.

1       9.       The liquid ejection apparatus as set forth in claim 5, wherein the first  
2       liquid mixing portions are formed by superposing liquid droplets of the plural  
3       colors while varying the ejected number of the liquid droplet per the unit area,  
4       when the head member transverses the first region in the first direction.

1       10.      The liquid ejection apparatus as set forth in claim 1, wherein the  
2       nozzle groups are at least three groups respectively associated with cyan  
3       liquid, magenta liquid and yellow liquid.

1 11. The liquid ejection apparatus as set forth in claim 1, wherein the unit  
2 area includes a matrix pattern constituted by a plurality of pixels each of which  
3 is associated with one liquid droplet.

1 12. The liquid ejection apparatus as set forth in claim 1, wherein a size of  
2 the unit area is variable according to the ejection pattern data.

1 13. An apparatus for controlling a liquid ejection apparatus, which  
2 comprises:

3 a head member, provided with nozzles including a plurality of nozzle  
4 groups each associated with one of a plurality of colors of liquid;

5 a plurality of pressure fluctuation generator, each of which is operable  
6 to generate pressure fluctuation in liquid in each of the nozzles to eject a liquid  
7 droplet therefrom; and

8 a carriage, operable to carry the head member so as to reciprocately  
9 transverse a first region in which a medium, on which the liquid droplet is  
10 landed, is placed, the controlling apparatus comprising:

11 a signal generator, operable to generate a first signal and a second  
12 signal;

13 a controller, operable to drive the pressure fluctuation generator  
14 according to the first signal and ejection pattern data in a case where the head  
15 member transverse the first region in a first direction, and to drive the pressure  
16 fluctuation generator according to the second signal and the ejection pattern  
17 data in a case where the head member transverse the first region in a second  
18 direction opposite to the first direction; and

19           a pattern data adjuster, operable to adjust the ejection pattern data so  
20 as to vary an ejected number of the liquid droplet per a unit area, for each of  
21 the nozzle groups.

1       14.       The controlling apparatus as set forth in claim 13, wherein the first  
2 signal and the second signal are different from each other.

1       15.       The controlling apparatus as set forth in claim 13, wherein the first  
2 signal and the second signal are identical with each other.

1       16.       The controlling apparatus as set forth in claim 13, further comprising a  
2 tone confirmation controller, operable to control the pattern data adjuster, the  
3 controller and the carriage such that:

4           at least one first liquid mixing portion, at which liquid droplets of the  
5 plural colors are superposed, is formed on the medium when the head member  
6 transverses the first region in the first direction; and

7           a plurality of second liquid mixing portions, at which liquid droplets of  
8 the plural colors are superposed while varying the ejected number of the liquid  
9 droplet per the unit area, are formed on the medium when the head member  
10 transverse the first region in the second direction,

11           wherein the at least one first liquid mixing portion and the second  
12 liquid mixing portions are arranged on the medium in a comparative manner.

1       17.       The controlling apparatus as set forth in claim 16, wherein a plurality  
2 of first liquid mixing portions are formed.

1        18.        The controlling apparatus as set forth in claim 16, wherein:  
2                    the medium is placed in the first region movably in a third direction  
3 perpendicular to the first direction and the second direction;  
4                    the second liquid mixing portions are arranged in the second direction;  
5 and  
6                    the first liquid mixing portion and the second liquid mixing portions are  
7 adjacent in the third direction.

1        19.        The liquid ejection apparatus as set forth in claim 16, wherein:  
2                    the medium is placed in the first region movably in a third direction  
3 perpendicular to the first direction and the second direction;  
4                    the second liquid mixing portions are arranged in the third direction;  
5 and  
6                    the first liquid mixing portion and the second liquid mixing portions are  
7 adjacent in the second direction.

1        20.        The liquid ejection apparatus as set forth in claim 13, wherein the  
2 pattern data adjuster adjusts the ejection pattern data so as to vary relative  
3 percentages among liquid droplets of the respective colors in all liquid droplets  
4 ejected in the unit area.

1        21.        The liquid ejection apparatus as set forth in claim 17, wherein the first  
2 liquid mixing portions are formed by superposing liquid droplets of the plural  
3 colors while varying the ejected number of the liquid droplet per the unit area,

4 when the head member transverses the first region in the first direction.

1 22. The controlling apparatus as set forth in claim 13, wherein the unit  
2 area includes a matrix pattern constituted by a plurality of pixels each of which  
3 is associated with one liquid droplet.

1 23. The controlling apparatus as set forth in claim 13, wherein a size of  
2 the unit area is variable according to the ejection pattern data.

1 24. A method of adjusting the ejected number of the liquid droplet per the  
2 unit area, performed in the liquid ejection apparatus as set forth in claim 1,  
3 comprising steps of:

4 forming at least one first liquid mixing portion, at which liquid droplets  
5 of the plural colors are superposed, on the medium when the head member  
6 transverses the first region in the first direction;

7 forming a plurality of second liquid mixing portions, at which liquid  
8 droplets of the plural colors are superposed while varying the ejected number  
9 of the liquid droplet per the unit area, on the medium when the head member  
10 transverse the first region in the second direction;

11 comparing the second liquid mixing portions with the first liquid mixing  
12 portion to select one of the second liquid mixing portions having a tone closest  
13 to a tone of the first liquid mixing portion; and

14 adjusting the ejection pattern data so as to correspond to an ejected  
15 number of the liquid droplet per the unit area which is associated with the  
16 selected one of the second liquid mixing portions.

1     25.     The adjusting method as set forth in claim 24, wherein the comparing  
2     step is performed with operator's eyes.

1     26.     The adjusting method as set forth in claim 24, wherein the comparing  
2     step is performed with a colorimetry device.

1     27.     The adjusting method as set forth in claim 24, further comprising  
2     steps of:

3             forming a plurality of third liquid mixing portions, at which liquid  
4     droplets of the plural colors are superposed while varying the ejected number  
5     of the liquid droplet per the unit area, on the medium when the head member  
6     transverses the first region in the first direction;

7             comparing the third liquid mixing portions with the first liquid mixing  
8     portion to select one of the second liquid mixing portions having a tone closest  
9     to a tone of the first liquid mixing portion; and

10            adjusting the ejection pattern data so as to correspond to an ejected  
11     number of the liquid droplet per the unit area which is associated with the  
12     selected one of the third liquid mixing portions.

1     28.     A liquid ejection apparatus, comprising:

2             a head member, comprising a nozzle face formed with nozzles;

3             a plurality of pressure fluctuation generator, each of which is operable  
4     to generate pressure fluctuation in liquid in each of the nozzles to eject a liquid  
5     droplet therefrom;

6           a carriage, operable to carry the head member so as to transverse a  
7 first region in which a medium, on which the liquid droplet is landed, is placed;  
8           a controller, operable to drive the pressure fluctuation generator  
9 according to ejection pattern data in a case where the head member  
10 transverse the first region;  
11           a distance detector, operable to detect a distance between the nozzle  
12 face and the medium and  
13           a pattern data adjuster, operable to adjust the ejection pattern data so  
14 as to vary an ejected number of the liquid droplet per a unit area, in  
15 accordance with the distance.

1    29.     The liquid ejection apparatus as set forth in claim 28, wherein:  
2           the nozzles includes a plurality of nozzle groups each associated with  
3 one of a plurality of colors of liquid; and  
4           the pattern data adjuster adjust the ejection pattern data for each of  
5 the nozzle groups.

1    30.     The liquid ejection apparatus as set forth in claim 29, wherein the  
2 nozzle groups are at least three groups respectively associated with cyan  
3 liquid, magenta liquid and yellow liquid.

1    31.     The liquid ejection apparatus as set forth in claim 28, wherein the  
2 distance is detected based on a thickness of the medium and a distance  
3 between the nozzle face and a surface in the first region on which the medium  
4 is placed.

1 32. The liquid ejection apparatus as set forth in claim 28, further  
2 comprising a gap adjuster, operable to vary the distance, and to acquire  
3 information regarding the distance.

1 33. The liquid ejection apparatus as set forth in claim 28, further  
2 comprising a storage, operable to store a variation rate of the ejected number  
3 in association with the distance.

1 34. The liquid ejection apparatus as set forth in claim 33, wherein the  
2 variation rate is at least two-bit data representing whether the distance is  
3 enough to separate the liquid droplet into a main droplet and a satellite droplet.

1 35. The liquid ejection apparatus as set forth in claim 33, wherein the  
2 variation rate and the distance are associated with a table.

1 36. The liquid ejection apparatus as set forth in claim 28, wherein the unit  
2 area includes a matrix pattern constituted by a plurality of pixels each of which  
3 is associated with one liquid droplet.

1 37. The liquid ejection apparatus as set forth in claim 28, wherein the unit  
2 area is variable according to the ejection pattern data.

1 38. An apparatus for controlling a liquid ejection apparatus which  
2 comprises:

3           a head member, comprising a nozzle face formed with nozzles;  
4           a plurality of pressure fluctuation generator, each of which is operable  
5       to generate pressure fluctuation in liquid in each of the nozzles to eject a liquid  
6       droplet therefrom; and  
7           a carriage, operable to carry the head member so as to transverse a  
8       first region in which a medium, on which the liquid droplet is landed, is placed,  
9       the controlling apparatus comprising:  
10          a controller, operable to drive the pressure fluctuation generator  
11       according to ejection pattern data in a case where the head member  
12       transverse the first region;  
13          a distance detector, operable to detect a distance between the nozzle  
14       face and the medium and  
15          a pattern data adjuster, operable to adjust the ejection pattern data so  
16       as to vary an ejected number of the liquid droplet per a unit area, in  
17       accordance with the distance.

1       39.     The controlling apparatus as set forth in claim 38, wherein:  
2           the nozzles includes a plurality of nozzle groups each associated with  
3       one of a plurality of colors of liquid; and  
4           the pattern data adjuster adjust the ejection pattern data for each of  
5       the nozzle groups.

1       40.     The controlling apparatus as set forth in claim 38, wherein the  
2       distance is detected based on a thickness of the medium and a distance  
3       between the nozzle face and a surface in the first region on which the medium

4 is placed.

1 41. The controlling apparatus as set forth in claim 38, further comprising a  
2 gap adjuster, operable to vary the distance, and to acquire information  
3 regarding the distance.

1 42. The controlling apparatus as set forth in claim 38, further comprising a  
2 storage, operable to store a variation rate of the ejected number in association  
3 with the distance.

1 43. The controlling apparatus as set forth in claim 42, wherein the  
2 variation rate is at least two-bit data representing whether the distance is  
3 enough to separate the liquid droplet into a main droplet and a satellite droplet.

1 44. The controlling apparatus as set forth in claim 42, wherein the  
2 variation rate and the distance are associated with a table.

1 45. The controlling apparatus as set forth in claim 38, wherein the unit  
2 area includes a matrix pattern constituted by a plurality of pixels each of which  
3 is associated with one liquid droplet.

1 46. The controlling apparatus as set forth in claim 38, wherein the unit  
2 area is variable according to the ejection pattern data.